Silvicultural Systems

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High Forest Systems

- **Systems of Concentrated Regeneration**
  - **Clearfelling Systems**
    1. Clearfelling System.
    2. The Clear Strip System
    3. The Alternate Strip System.
  - **Shelterwood Systems**
    1. Uniform system
    2. Group „
    3. Strip „
    4. Irregular „
    5. Indian Irregular System
- **Systems of Diffused Regeneration**
  - **Selection System**
    1. Single Tree Selection
    2. Group Selection
- **Accessory Systems**
  1. Two storeyed High Forest
  2. High forest with reserve

Systems of Concentrated Regeneration

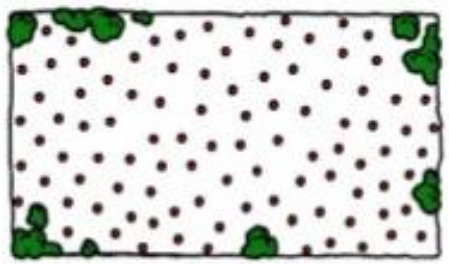
- ✔ **CLEAR FELLING SYSTEM**
- ✔ **SHELTERWOOD SYSTEM**

RECAP

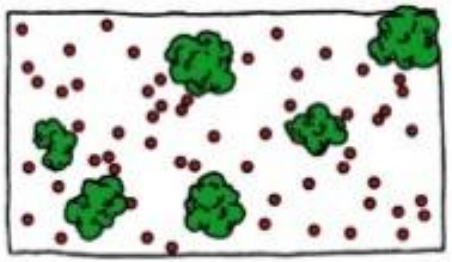
CLEARCUTTING

An even-aged system where all or nearly all of the trees are harvested at one time.

Clearcut



Seed-Tree

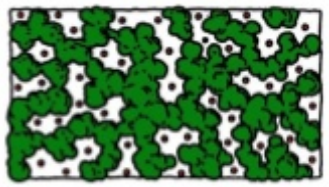


Forest Types: Pines, Spruces, Oaks

SHELTERWOOD

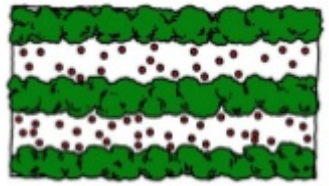
An even-aged system where one or two cuts are used prior to the final harvest. The first two cuts stimulate and establish advanced regeneration before the final harvest cut.

Uniform



Group

Strip

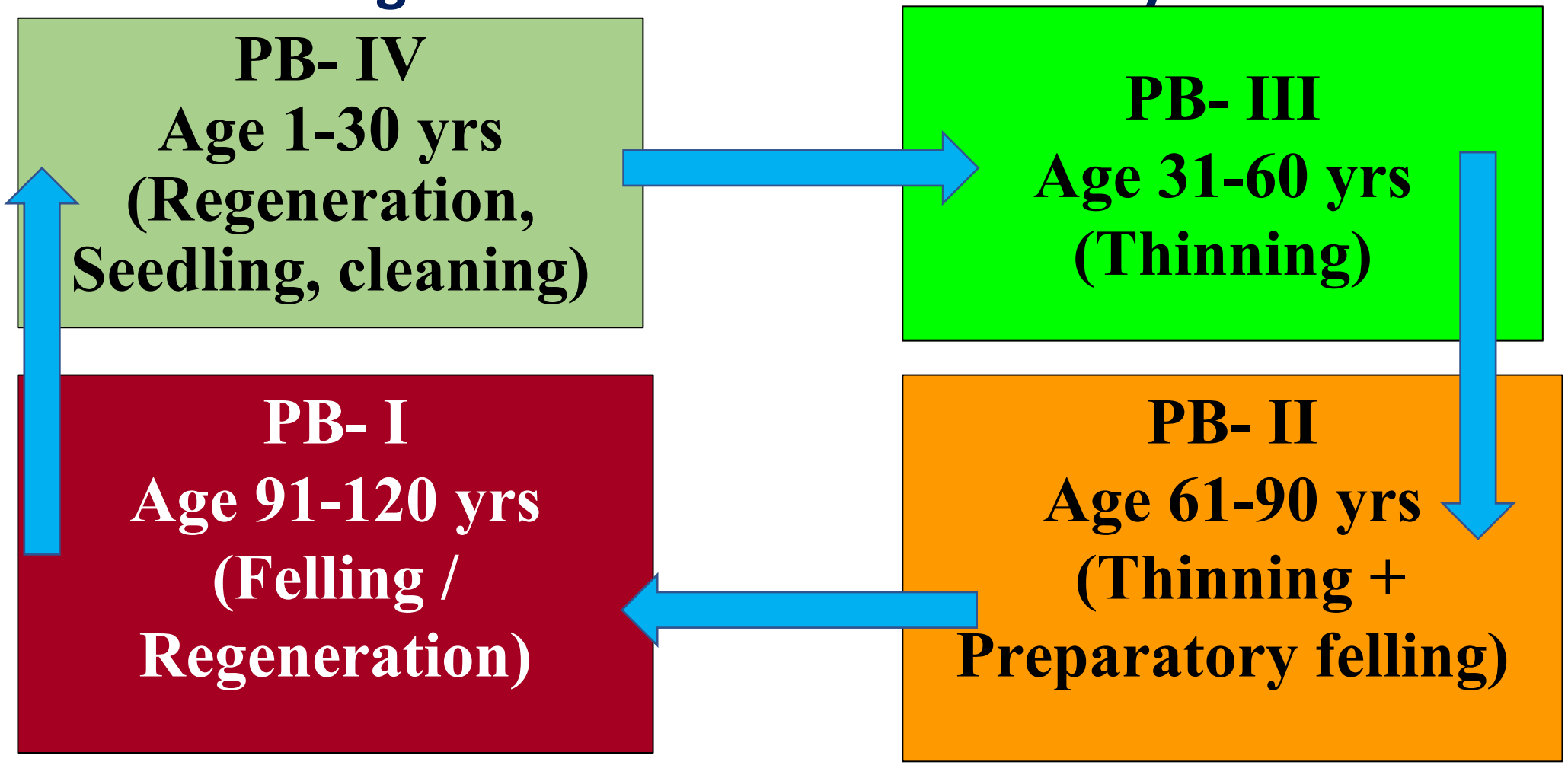


Final Crop Should Be:

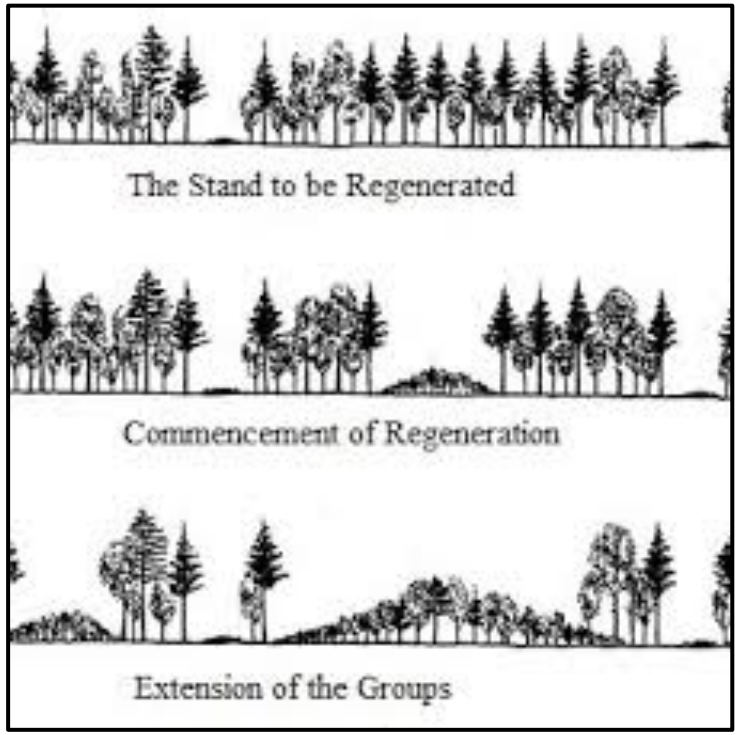
- Windfirm
- Good Seeders
- Undamaged by Logging

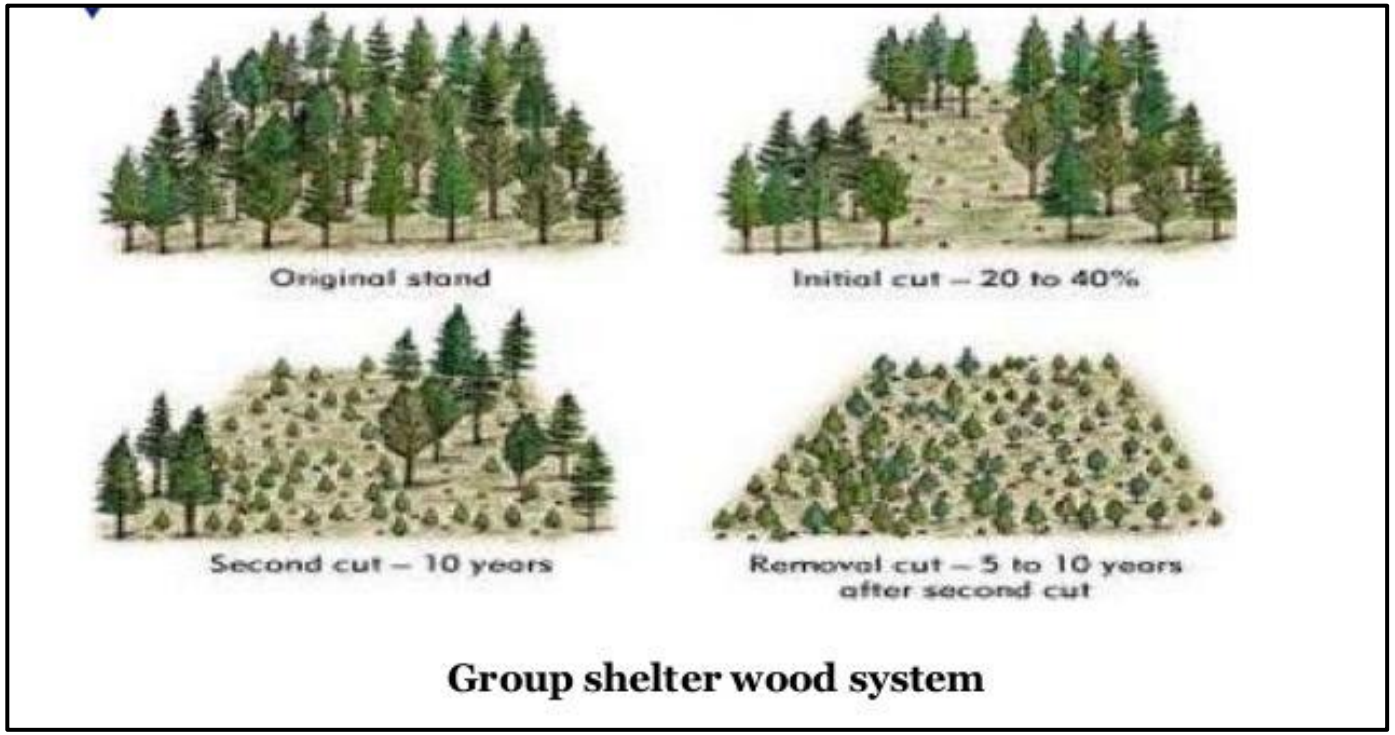
THE UNIFORM SYSTEM

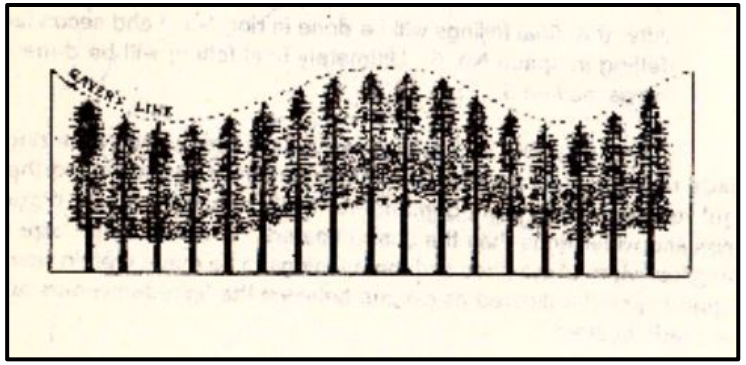
Working of Periodic Blocks in a 120 year rotation



THE GROUP SYSTEM

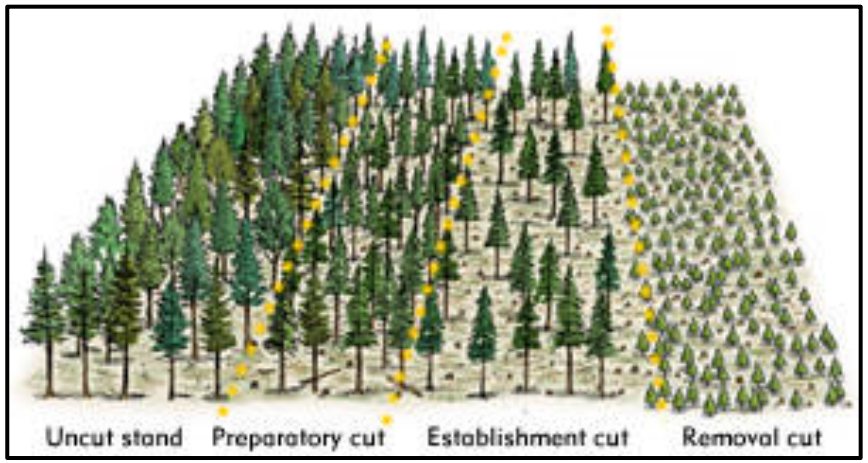


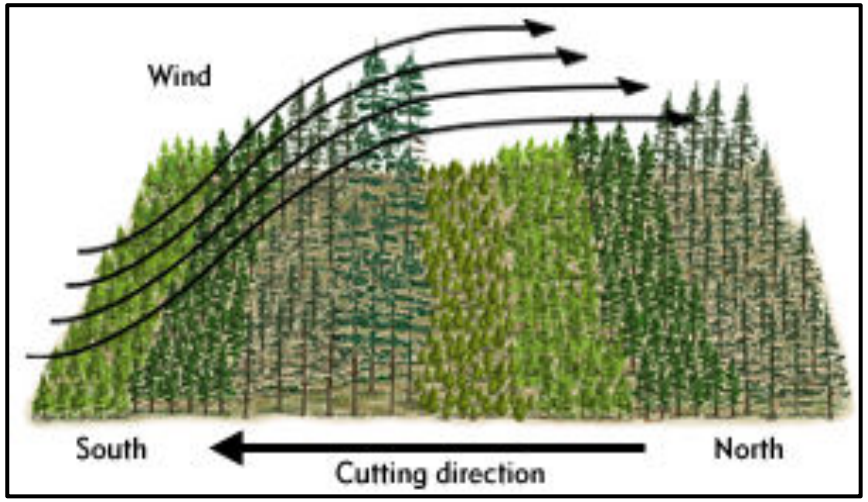




THE SHELTERWOOD STRIP SYSTEM

What is it?





STRIP SYSTEM

FELLINGS DONE IN STRIPS ALONG ONE SIDE OF COMPARTMENT & PROGRESS AGAINST DIRECTION OF WIND.

Wind is not a serious problem in India and the execution is complex

SYSTEM

MODIFICATION OF UNIFORM SYSTEM

ADVANCE GROWTH OF VARIOUS AGES & SIZES UPTO 40 CM DIA RETAINED AS FUTURE CROP.

IMMATURE MATERIAL NOT SACRIFICED.

CROP CHARACTER: UN- EVEN AGED.

In tropical rain forest , REGENERATION PERIOD IS 3-10 YEARS

Initially TWO STOREYED FOREST but finally BECOMES UN EVEN AGED as immature crop is retained .

Application : Deodar & Sal. Also in Arunachal & Andamans (Andaman Canopy lifting System)

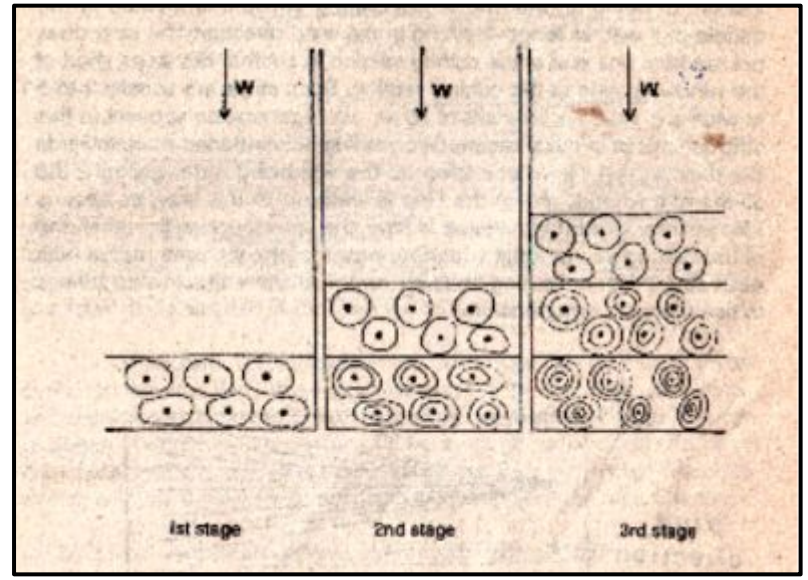
THE STRIP AND GROUP SYSTEM

What is it?

COMBINATION OF STRIP AND GROUP SYSTEMS

FELLINGS DONE IN THE STRIP CONFORM TO THE GROUP SYSTEM INSTEAD OF UNIFORM SYSTEM

STRIPS AGAINST WIND DIRECTION



NOT PRACTICED IN INDIA

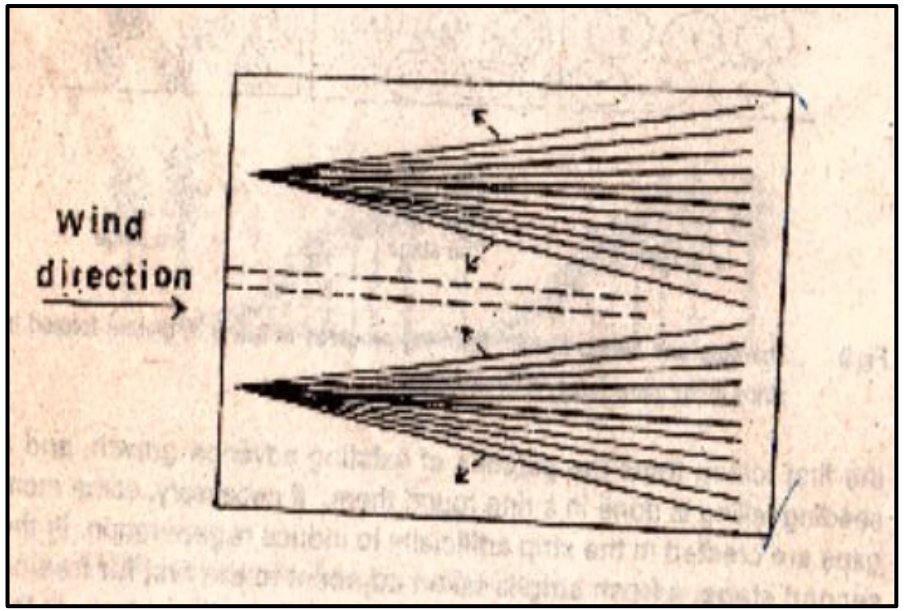
THE WEDGE SYSTEM

What is it?

STRIPS DO NOT RUN FROM ONE END OF CUTTING SECTION TO ANOTHER, BUT STOPS SHORT OF THE WINDWARD SIDE OF THE CUTTING SECTION.

STRIPS WIDENED TOWARDS LEEWARD SIDE GIVING SHAPE OF WEDGE.

THE OTHER AREAS REMOVED IN STRIP FELLINGS LATER.



NOT PRACTICED IN INDIA - WIND IS NOT A SERIOUS PROBLEM- COMPLICATED

ADVANTAGES of Shelterwood System

PRODUCES A NEARLY EVEN-AGED CROP

ENSURES BETTER REGENERATION

TENDING OPERATIONS ARE FACILITATED AS THE AGE CLASSES OCCUR ON SEPARATE AREAS.

THE SYSTEM IS HIGHLY FLEXIBLE FOR REGENERATION OF LIGHT DEMANDERS / SHADE BEARERS / MIXTURE OF BOTH

LESS RISK OF SOIL DETERIORATION AND EROSION.

LESS DANGER OF INVASION OF THE AREA BY WEEDS AND GRASSES

SUPERIOR TO CLEAR FELLING SYSTEM, aesthetically.

DISADVANTAGES of Shelterwood System

LIKELIHOOD OF MUCH DAMAGE TO THE YOUNG CROP AS OVERWOOD IS REMOVED IN STAGES.

THE ISOLATED SEED BEARERS ARE SUSCEPTIBLE TO WIND DAMAGE.

HEAVY SEEDING FELLING MAY INVITE INVASION BY WEEDS AND REGENERATION MAY BE AFFECTED.

WEEDING AND CLEANING HAVE TO BE DONE FOR LONGER PERIOD AND THE NATURAL REGENERATION BECOMES COSTLY.

REQUIRES A HIGH DEGREE OF SUPERVISION AND SKILL FOR MANAGEMENT OF THE FORESTS.

System of Diffused Regeneration
SELECTION SYSTEM

Vertical Profile – A Selection Forest

Vertical Profile - Group Selection System

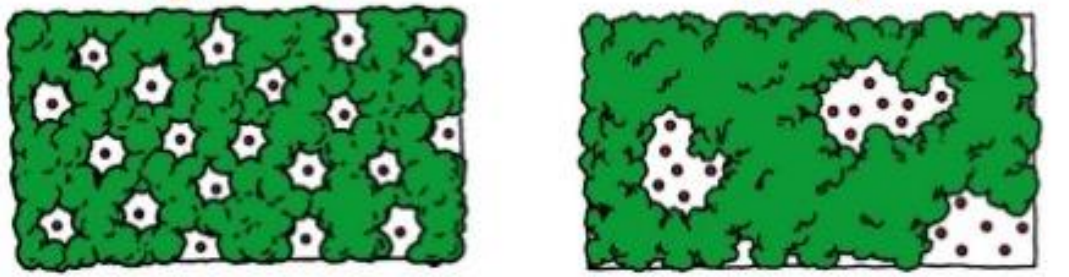
SELECTION SYSTEM

TYPES

SELECTION

An uneven-aged system where trees of all sizes are harvested on a cycle of about 10-15 years.

A selection harvest IS NOT a diameter-limit cut!



SELECTION SYSTEM – Diffused Regeneration

The fellings and regeneration are distributed over the whole of the area and the resultant crop is so UNEVEN AGED that the trees of ALL AGES are found mixed together over every part of the area.

In earlier systems – operations are concentrated and done during part of rotation (except thinnings) and are even aged.

Close to nature, *but even in nature such ideal condition does not occur*. Regeneration in small groups because of periodicity in seed years.

SELECTION SYSTEM – Diffused Regeneration

Felling Cycle : If area is large, divided into coupes. When fellings over in last coupe, first coupe is again visited . It is the interval between successive main fellings in the same area.

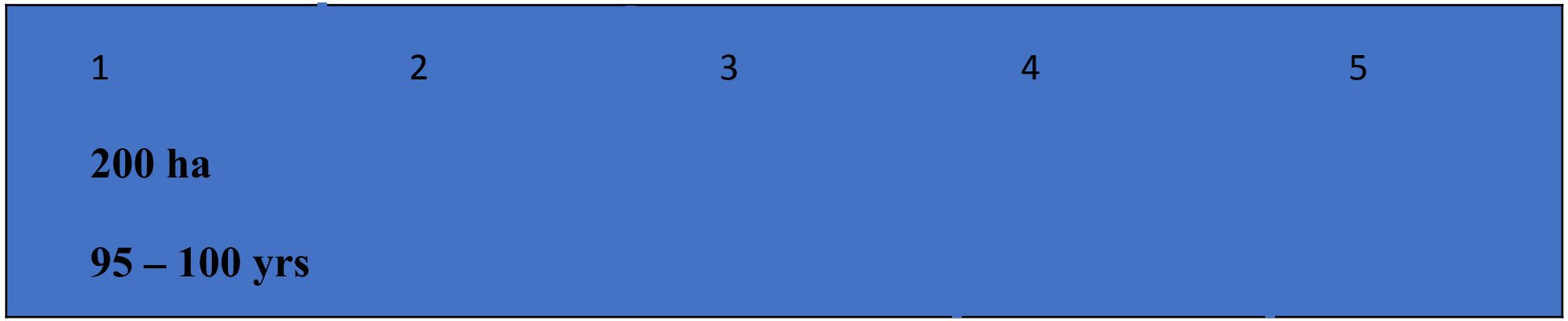
In Indian conditions – usually should be 10-20 years (normally 10 years corresponding with working plan period)

Mode of regeneration : Mostly natural regeneration is relied upon, but artificial regeneration is also necessary

SELECTION SYSTEM – Diffused Regeneration

FELLING CYCLE : The number of coupes will be equal to the number of years in the Felling Cycle.

- **Felling Series - 1000 ha**
- **Felling Cycle - 5 yrs**
- **Rotation Age - 100 yrs**
- **No. of Coupes - ?**



SELECTION SYSTEM – Diffused Regeneration

WHILE WORKING ON A FELLING CYCLE, THE ANNUAL INCREMENT OF THE TOTAL FELLING SERIES IS TAKEN OUT FROM ONE COUPE.

IF THE FELLING CYCLE IS N YEARS, ANNUAL INCREMENT IS TAKEN FROM ONE COUPE WHOSE AREA IS 1/N OF THE AREA OF FELLING SERIES.

INTENSITY OF FELLING IN THE COUPE IS N TIMES HEAVIER COMPARED TO THE DEGREE OF OPENING WHICH WOULD TAKE PLACE IF THE WHOLE FELLING SERIES WOULD HAVE GONE OVER EVERY YEAR UNDER THE TRUE SELECTION SYSTEM.

SELECTION SYSTEM

SINGLE TREE SELECTION

Single-tree selection system creates and maintains a fairly uniform interspersion of age and size classes by removing individual trees to open space for a new age class and to reduce crowding among the immature ones. It creates few openings larger than the diameter of a mature tree crown.

Single-tree selection system -- before cut

Single-tree selection system -- after cut

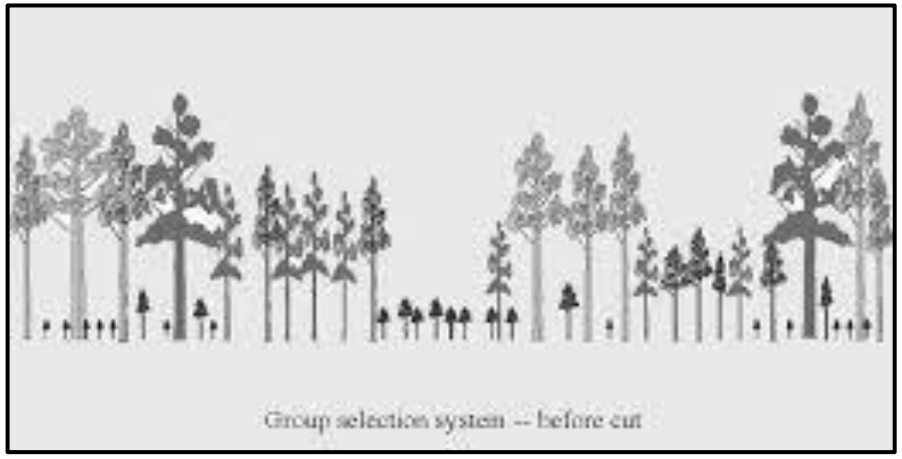
SELECTION SYSTEM

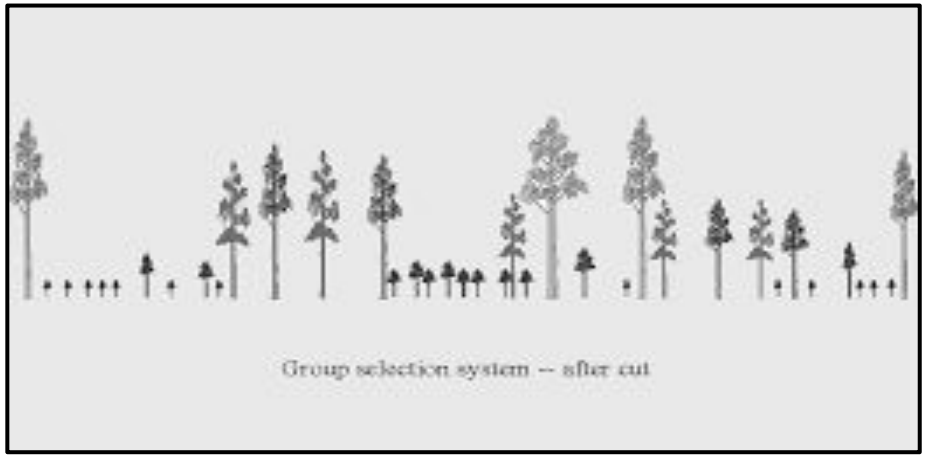
GROUP SELECTION

TREES ARE FELLED IN SMALL GROUPS AND NOT AS SCATTERED SINGLE TREES

SUITABLE FOR LIGHT DEMANDERS.

DIFFERENTIATED FROM GROUP SYSTEM THAT THEY ARE NOT ENLARGED CENTRIFUGALLY AND THE CROP IS UN EVEN-AGED.





ADVANTAGES of SELECTION SYSTEM

BIOLOGICALLY SUPERIOR – RESISTANT TO BIOTIC/ ABIOTIC FACTORS, DIVERSITY

NO HORIZONTAL COMPETITION-MORE TIMBER YIELD

HIGH QUALITY TIMBER (eg. TEAK FROM SELECTION SYSTEM)

CONTINUOUS COVER – LESS SOIL DETERIORATION

MORE GROWING STOCK – LOWER AGE CLASS TRESS GROW BELOW OLDER TREES

NATURAL REGENERATION COMES UP EASILY- USE OF EVERY SEED YEAR

DISADVANTAGES of SELECTION SYSTEM

LESS ECONOMICAL AS OPERATIONS ARE SCATTERED

SUCCESS OF REGENERATION DIFFICULT TO ASSESS

WHEN VALUABLE SPS. REMOVED – SPACE MAY BE FILLED BY REGENERATION OF LESS VALUABLE SPS.

SEED OBTAINED FROM GOOD AND BAD TREES, MAY CAUSE GENETIC DETERIORATION IN FUTURE CROP.

DAMAGE TO YOUNGER TREES WHILE FELLING

KNOTTY AND TAPERING TIMBER IN UPPER PART

GRAZING & FIRE CONTROL - DIFFICULT TO ACHIEVE

SELECTION SYSTEM

Suitability & Indian application

STEEP HILLS

CATCHMENT AREAS

SHADE BEARERS

PROBLEMS OF DISPOSAL IN FAR OFF AREAS

MARKET REQUIREMENTS FOR PARTICULAR SPS.

- Sal & Teak

- Fir and spruce
- Tropical evergreen forests
- Semi Evergreen forests

ACCESSORY SYSTEMS

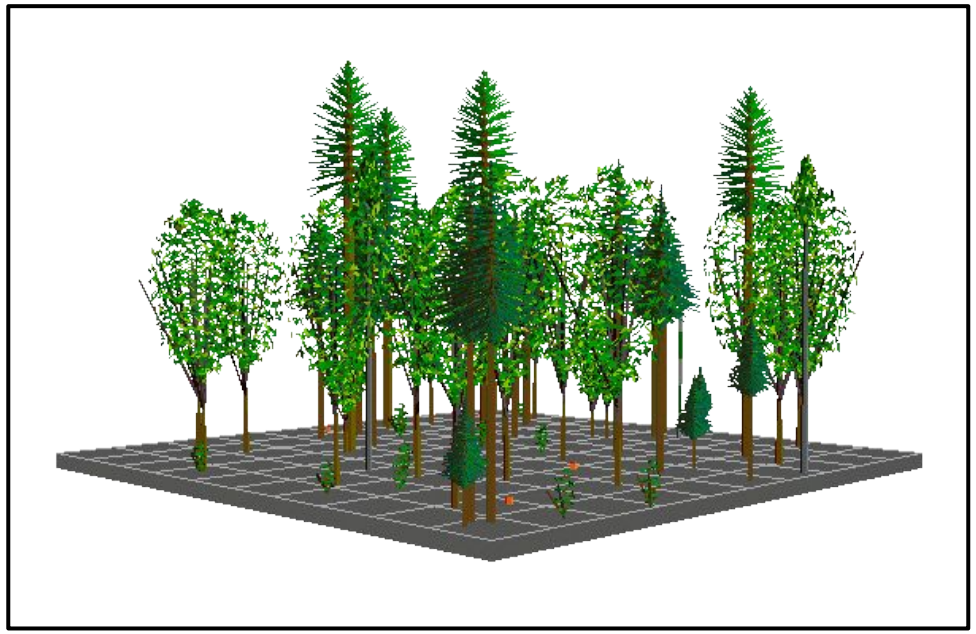
Modifications of high forest systems which originates from even aged systems resulting in irregular or two storied forest

- Two storied high forest
- High forest with reserves system
- Improvement fellings

ACCESSORY SYSTEMS

Two Storied High Forest System

Silvicultural System which results in formation of a two storied forest, i.e., canopy can be differentiated into two strata in each of which the dominant sps. is usually different. Crop in each strata is approx. even aged and from seedling origin.



Eg. Deodar under Chir,
Oak under Chir

ACCESSORY SYSTEMS

Two Storied High Forest System

Advantages

- Protection by lower storey
- Increase production by two crops
- Early returns
- To change sps. gradually
- Propagate shade bearing/frost tender sps.

Disadvantages

- Underplanting is a difficult operation
- Damage to under storey during felling
- Under storey may affect growth of upper storey

ACCESSORY SYSTEMS

High Forest with Reserves system

Selected trees of the crop being regenerated are retained for part or whole of the second rotation to produce large sized timber. Eg. In Uniform System, some trees retained for increment.

ACCESSORY SYSTEMS

Improvement fellings

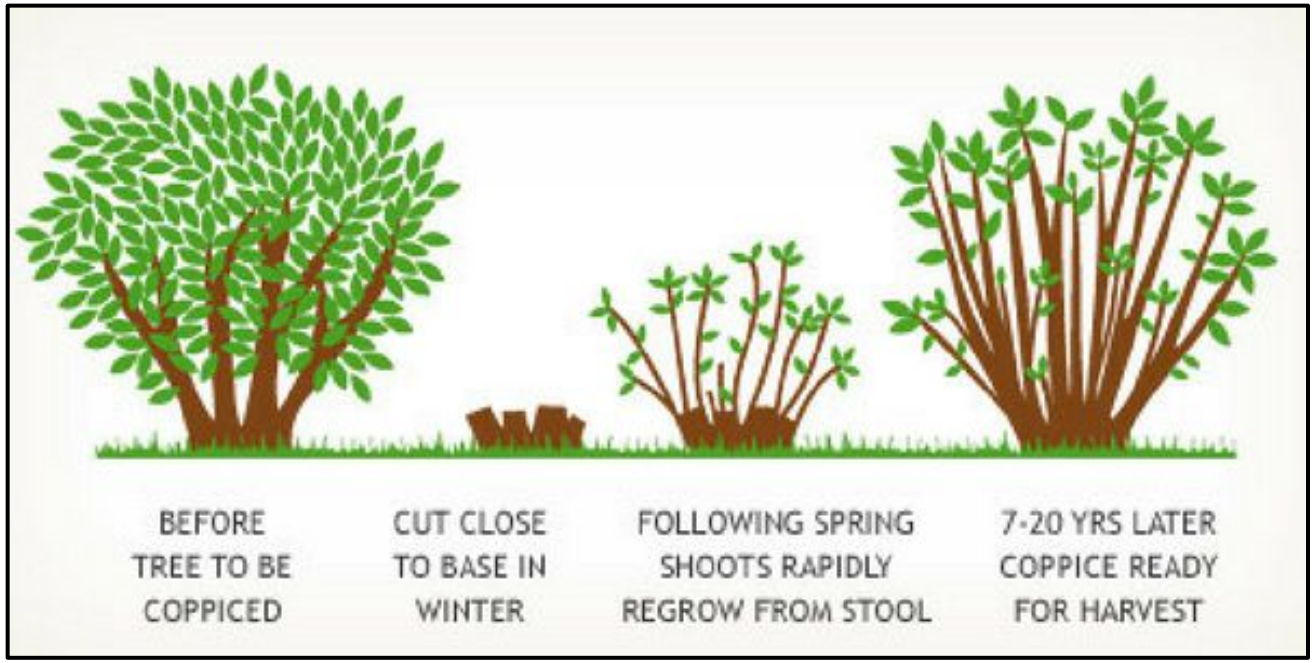
Removal of inferior growing stock for better growth of more valuable trees usually in mixed un even aged forests. Eg Selection cum improvement fellings.

In selection felling, exploitable girth fixed and trees falling in that limit felled.
Not so in improvement felling.

COPPICE SYSTEMS

Coppice shoots from adventitious buds on the stumps of felled trees.

*** For sps which coppice vigorously, atleast in early life, rotation is necessarily short.**



COPPICE SYSTEMS

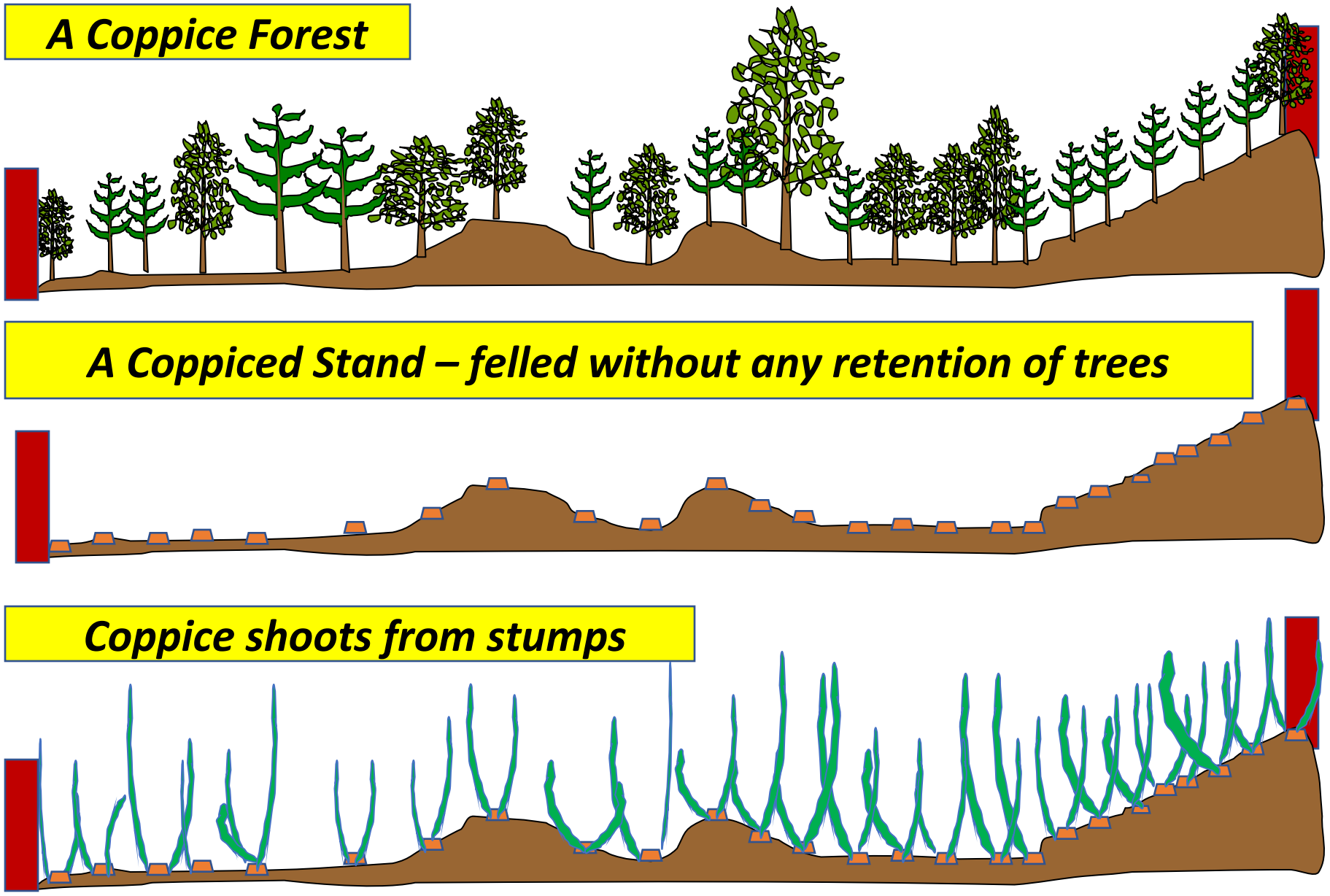
COPPICE SYSTEMS

(i) Simple Coppice System

Silvicultural System based on stool coppice in which the old crop is clear felled completely with no reservation for shelterwood or any other purpose.

Clear felling fixed area and regeneration by coppice shoots (Low forest system)

Simple Coppice System



COPPICE SYSTEMS

(i) Simple Coppice System

Important Considerations:

- Best season for coppicing – little before spring- large reserve of food in roots
- Lower- not damaged by wind or animals, independent roots if very low, stump splitting/drying up from top avoided
- Stump shall not split, bark not detached, slopes in one direction so that rain water may quickly drain off
- Blanks by planting stumps, but seldom by sowing

COPPICE SYSTEMS

(i) Simple Coppice System

Advantages :

- Simple
- Assurance of regeneration
- Faster returns and economical

Disadvantages

- Small sized timber, more nutrients from soil/resources
- Supplementing by sowing/planting after few rotation
- Damage from frost

COPPICE SYSTEMS

(ii) Coppice of two rotations system

- AT THE END OF THE FIRST ROTATION OF COPPICE, A FEW SELECTED POLES ARE LEFT SCATTERED SINGLY OVER THE COUPE TO ATTAIN BIGGER SIZE IN THE SECOND ROTATION .
- IN SECOND ROTATION FELLING, THESE POLES ARE FELLED ALONG WITH THE COPPICE, BUT NEW POLES FROM AMONG COPPICE OF FIRST ROTATION AGE ARE LEFT FOR SECOND ROTATION
- OBJECTIVE - TO PRODUCE LARGE SIZED TIMBER IN ADDITION TO THE POLES OF ORDINARY SIZE.

COPPICE SYSTEMS

(iii) The Shelterwood coppice system

- IN FIRST CLEAR FELLING, SOME SHELTERWOOD(125-150/HA), IS RETAINED FOR FROST PROTECTION TILL COPPICE SHOOTS ARE FULLY ESTABLISHED AND THEN THEY ARE REMOVED GRADUALLY.
- APPLICABLE WHERE FROST IS COMMON, LOCALITY IS GOOD, SPS CAN COPPICE FOR LONGER AGE, DEMAND FOR LARGE TIMBER, LONGER ROTATION

Just Representative

COPPICE SYSTEMS

(iii) The Shelterwood coppice system

Coppice of two rotations	Shelterwood Coppice
• Some **retained throughout** second rotation • Large sized timber • Normal areas	• Some **retained for part** of second rotation • Frost protection • Frosty, good soil, longer rotation, and coppice potential for longer age

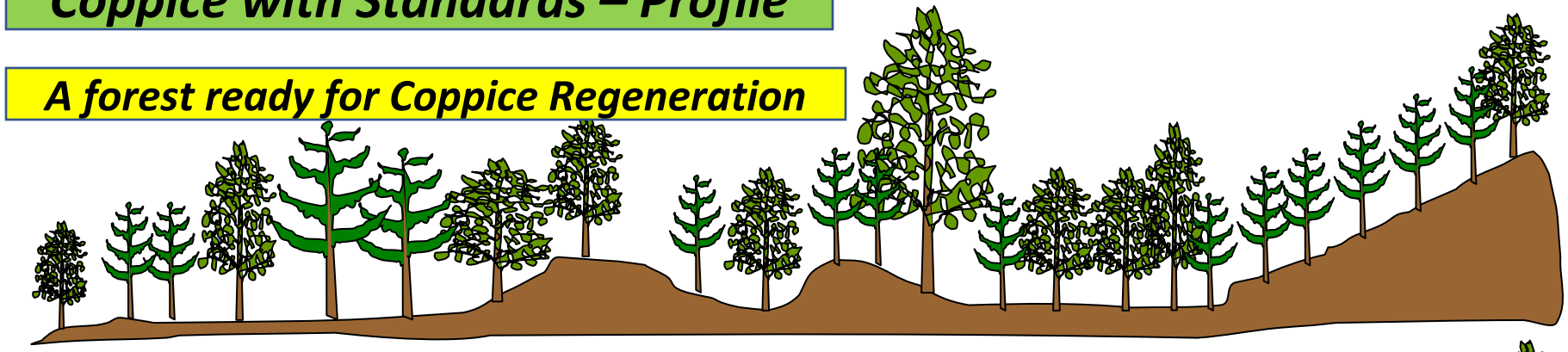
COPPICE SYSTEMS

(iv)Coppice with Standards System

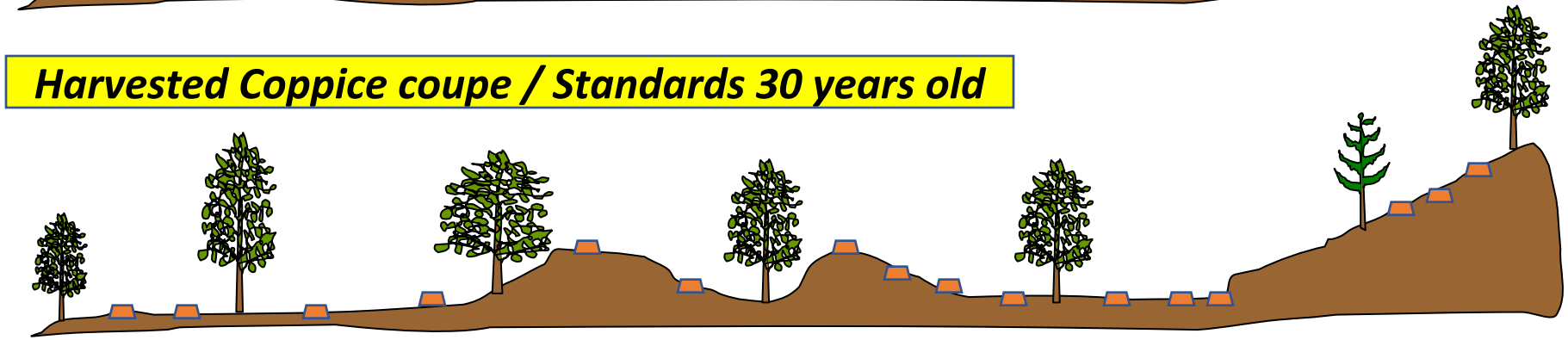
Over wood of standards , usually of seedling origin and composed of trees of various ages is kept over coppice for periods which may be multiples of coppice rotation and a permanent feature of the crop throughout its life

Coppice with Standards – Profile

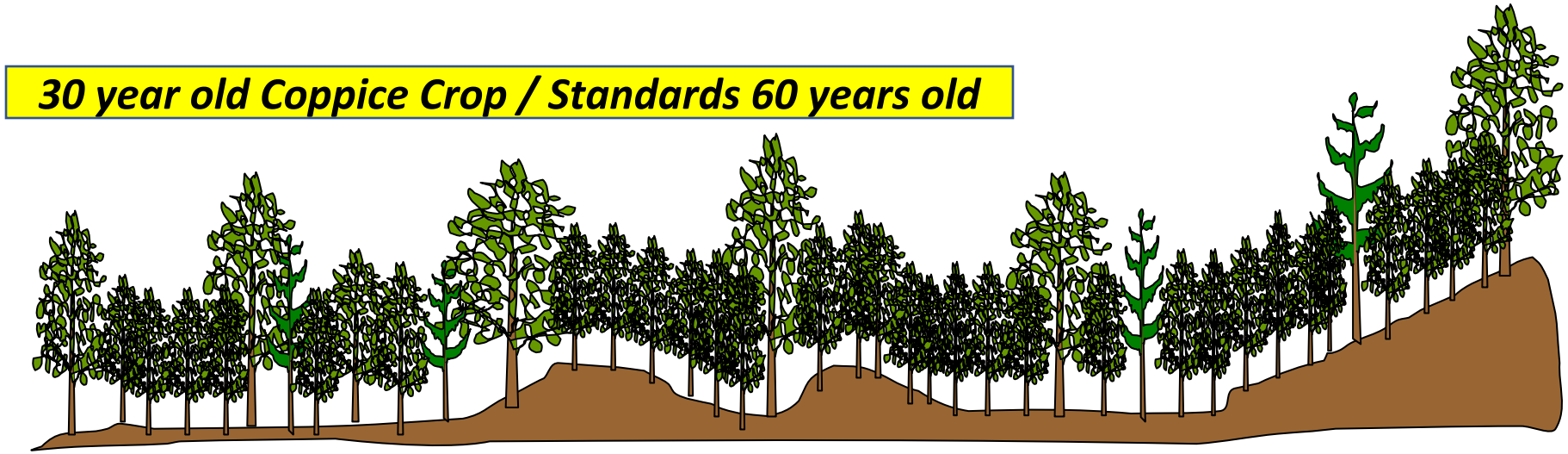
A forest ready for Coppice Regeneration



Harvested Coppice coupe / Standards 30 years old



30 year old Coppice Crop / Standards 60 years old



COPPICE SYSTEMS

(iv)Coppice with Standards System

Constitution of Crop :

- lower storey – even age – simple coppice-small wood
- Upper storey – seedling origin- different age classes , treated as high forest (by selection system) for large timber

Rotation :

- One for coppice , another for standards , rotation for standards is a multiple of coppice rotation

COPPICE SYSTEMS

(iv)Coppice with Standards System

COPPICE WITH STANDARDS

- STANDARDS FROM VERY BEGINNING, TREES OF SEEDLING ORIGIN, MAINTAINED FOR PERIODS WHICH IS MULTIPLES OF COPPICE ROTATION.
- LARGE SIZE TIMBER, FROST PROTECTION, SOIL CONS., SEEDLING REGENERATION TO MAINTAIN VIGOUR
- TWO ROTATIONS – ONE FOR STANDARD AND ANOTHER FOR COPPICE

COPPICE OF TWO ROTATION

- SELECTED AT BEGINNING OF SECOND ROTATION AND RETAINED ONLY FOR ONE EXTRA ROTATION
- ONLY LARGE SIZED TIMBER
- ONE ROTATION

COPPICE SYSTEMS

(iv)Coppice with Standards System

COPPICE WITH STANDARDS

- PERMANENT FEATURE THROUGHOUT LIFE OF CROP
- VARIETY OF REASONS
- TWO ROTATIONS

SHELTERWOOD COPPICE SYSTEM

- ONLY FOR A PART OF EACH ROTATION
- ONLY FOR FROST
- ONLY ONE ROTATION

COPPICE SYSTEMS

(iv)Coppice with Standards System

Conditions of Applicability

- Where there is demand both for firewood, poles and large sized timber
- Climatic factors inhibit use of simple coppice system as in irregular dry deciduous mixed forests which vary considerably in site quality, composition and density.

COPPICE SYSTEMS

(V) The Coppice with Reserves System

Evolved in central India for dry deciduous forests with low proportion of teak and sal, varied greatly in site quality , composition and density.

Salient Features

- Emphasis not on felling, but conservation
- Areas needing felling and Cons. Identified
- Felling based on needs of crop, people, site
- Pure teak crop & sacrificing immature teak avoided

COPPICE SYSTEMS

(V) The Coppice with Reserves System

Reservation of the Reserves

a) Reservation by Areas - under stocked, degraded land, water bodies, places of religious/tourist interest, dense pole crop

b) Reservation by Sps.- fruits, NWFP, rare sps., lac trees

c) Reservation by Trees – fixed girth class, supply of seed, advance growth

COPPICE SYSTEMS

(V) The Coppice with Reserves System

Regeneration

- Both by coppice and seedling (advance growth and seed)

Character of Crop

- Even aged coppice with uneven aged reserved crop scattered irregularly – uneven aged

COPPICE SYSTEMS

(V) The Coppice with Reserves System

Coppice with Standards	Coppice with Reserves
• Two storey • Distinct treatment and rotation for both storey • Standards uniformly spaced, occupy fixed space in canopy • Large size timber	• Irregular • No such distinction • Reserves are irregularly distributed • multifarious

COPPICE SYSTEMS

(V) The Coppice with Reserves System

Coppice with Standards

- One or two valuable sps
- Rigid system
- Immature crop sacrificed for obtaining coppice

Coppice with Reserves

- Several sps.
- Very elastic system
- Not Sacrificed

COPPICE SYSTEMS

(V) The Coppice with Reserves System

Advantages – Already dealt

Disadvantages

- **high skill in execution**
- **Reservation of large no. of trees affects coppice growth**

COPPICE SYSTEMS

(V) The Coppice with Reserves System

Applicability

- Crop varies greatly in density, composition, quality & proportion of valuable sps. is low
- Most sps are good coppicers and copping power of most valuable sps is vigorous
- Valuable sps are light demanders

COPPICE SYSTEMS

(vi)The Coppice Selection System

Salient Features

- Felling carried out on the principles of selection system, but regeneration is obtained by coppice
- Exploitable girth fixed and felling cycle decided. When coupe due for felling, only stems of over exploitable dia removed

Applicability

Not successful as main fellings allow insufficient light for coppice

COPPICE SYSTEMS

(vii)Pollard System

Pollard

- A tree whose stem has been cut off in order to obtain a flush of shoots usually above the height to which browsing animals can reach.

Pollard System : Pollarding trees periodically to obtain exploitable material

Ex : fuel in dry deciduous forests in TN, *Hardwickia pinnata* in Andhra Pradesh for fibre extraction

COPPICE SYSTEMS

(vii)The Pollard System

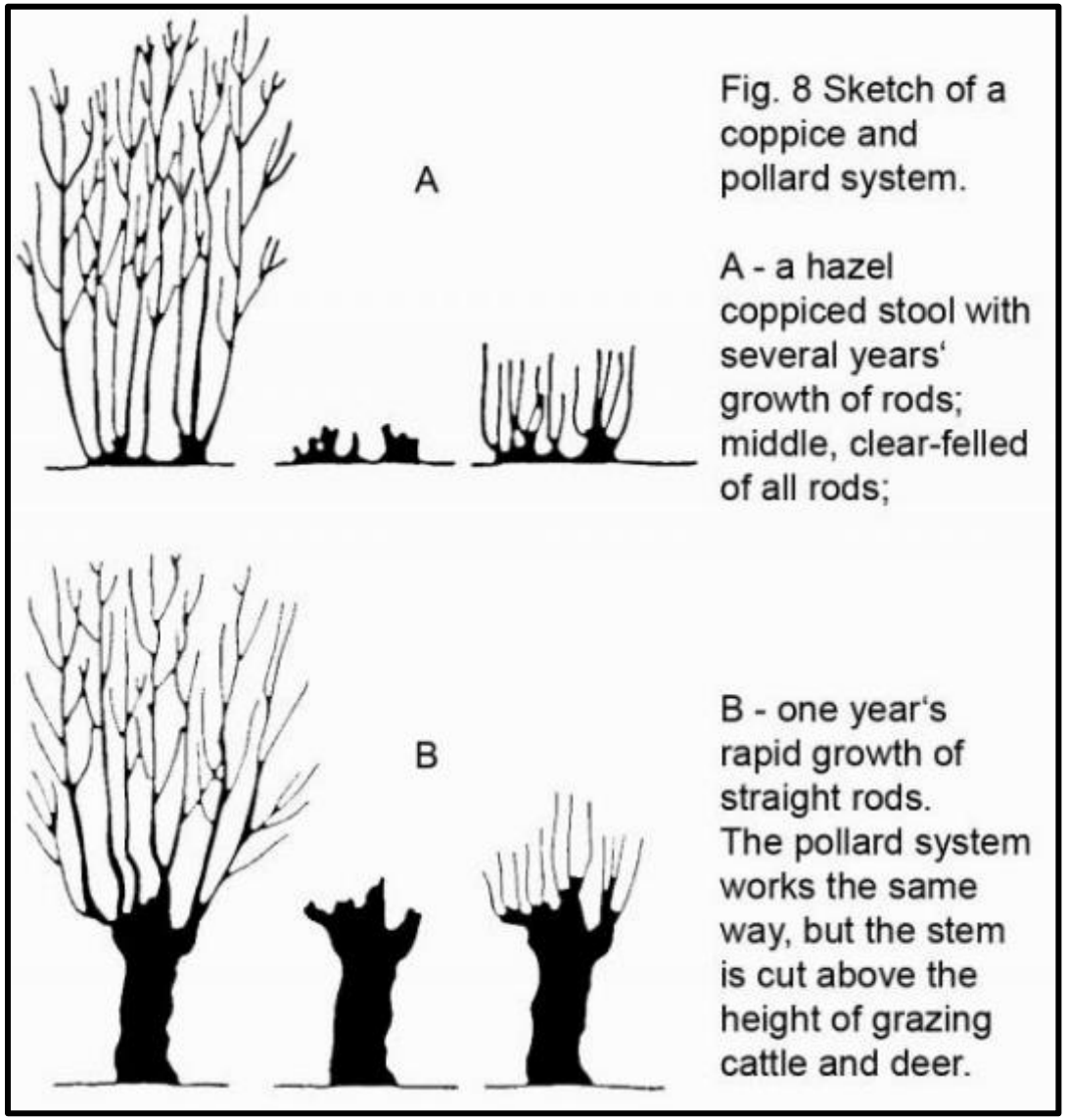


Fig. 8 Sketch of a coppice and pollard system.

A - a hazel coppiced stool with several years' growth of rods; middle, clear-felled of all rods;

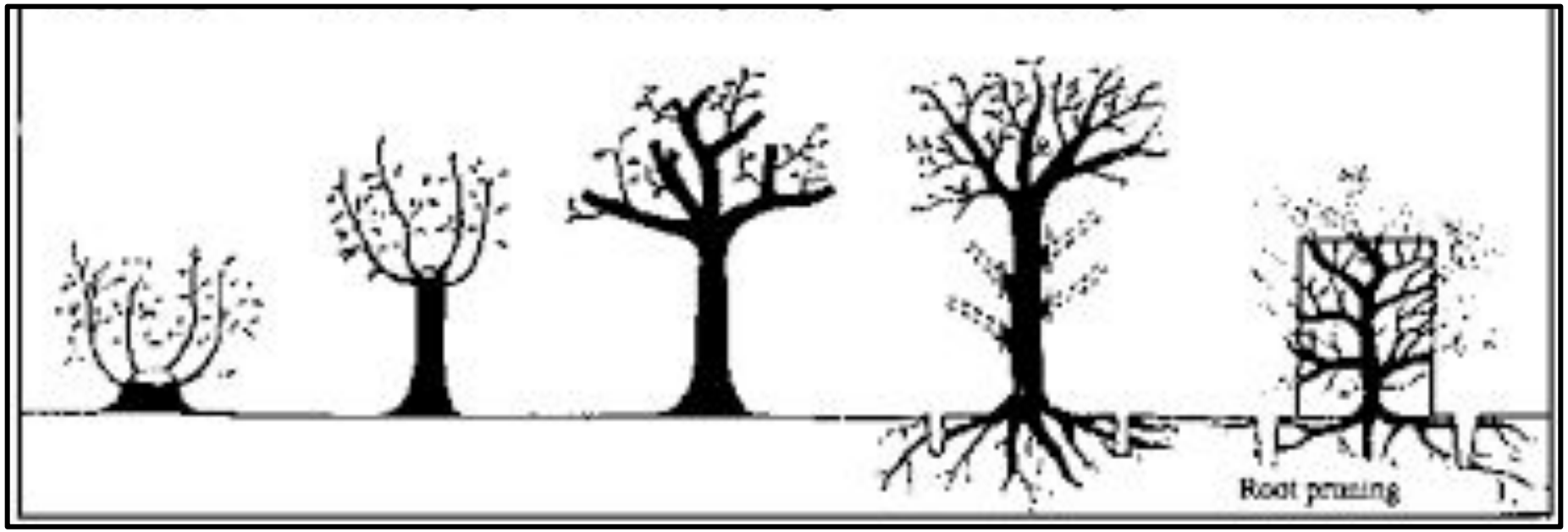
B - one year's rapid growth of straight rods. The pollard system works the same way, but the stem is cut above the height of grazing cattle and deer.

COPPICE SYSTEMS

(vii)The Pollard System

COPPICE SYSTEMS

Coppicing Pollarding Branch pruning Pruning Trimming



CONVERSIONS

What is it?

CONVERSION : CHANGE FROM ONE SILVICULTURAL SYSTEM OR ONE SPECIES TO ANOTHER (BOTH CROP COMPOSITION AND/OR SILVICULTURAL SYSTEM)

CONVERSIONS

Reasons

Reasons for change in crop composition :

1. Increasing Yield from forests : Eucalyptus and Poplars in U.P. 1.8 % of area, 18 % of world population,
2. Demands of Industry

CONVERSIONS

Reasons

Reasons for change in Silvicultural System:

1. **Adv of particular System : Earlier selection system resulted in irregular forests – then to uniform system (European learnings). Recent years Coppice with Reserves system in M.P in place of selection/C.W.S system.**
2. **Failure of an existing system : Uniform system in Sal failed in Haldwani and Ramnagar divisions. Indian Irregular Shelterwood system adopted. Similarly in case of Punjab shelterwood system.**

CONVERSIONS

Reasons

Reasons for change in Silvicultural System:

3. Advances in Knowledge of silviculture & regeneration : Sal in Bihar & M.P – conversion to uniform by clear felling followed by natural regeneration (seedling coppice) . Also teak in Kerala and Maharashtra.

4. Dev. of communications and increase in market demand: Selection system to systems of concentrated regeneration

CONVERSIONS

Conversion Trends:

1. Regeneration techniques perfected : Selection system to uniform system by clear felling followed by natural/artificial regeneration. Teak & Sal in M.P.
2. When regeneration not assured/protection in initial stages : Conversion to Indian Irregular Shelterwood system. Deodar forests in U.P.
3. Variation in site quality/crop composition : C.W.R based on coppice & seedling. Dry deciduous forests in central India

CONVERSIONS

Salient Points

Salient points :

1. Coppice less for indigenous sps and only high forests
2. Exotic like Eucalyptus – Coppice for 3 rotations
3. Only part of forest taken up for conversion (irregular to clear felling) during current working plan period.

CONVERSIONS

1) Monoculture plantations (Clear felling) to Andamans

Natural Profile : Plantation reclamation working circle

2) Forest under uniform system to Natural profile : Eco restoration working circle

CONVERSIONS

Andamans

1) ~~Convert to profile of unworked natural forests nearby. Sps as per IVI~~

2) Starting with cane and bamboo (in plantations), imp sps planted.

3) Other associates expected to come up.

4) Harvest in forests – over and above the profile in natural unworked forests nearby.

5) Irregular Shelterwood with selection felling conversion to natural profile

6) Marking/felling rules- Area with volume. check

Conversions

Teak Plantation reclamation

Conversions

Eco Restoration Circle

ANDAMAN & NICOBAR ISLANDS

Enumeration: All trees in annual coupe **gbh >=210cm** (Ornamental & hardwood species ; **>=180cm gbh** (softwood species)

Out of these only 2/3rd shall be marked for felling; 1/3rd shall be retained.

While marking the trees for felling IVI of the species in comparison to natural forests should be taken into consideration.

Biodiversity conservation rather than the demand or commercial value of the timber will be paramount importance for selection of species for felling.

Concentration of species in excess of the natural profile as per IVI of the species will be the over riding criteria for felling of the trees.

Target: highest, 1,35,523 cum in 1994-95

two government saw mills,

one in Chatham, South Andaman (installed capacity 24,000 cum pa)

one in Betapur, Middle Andaman (5000 cum pa)

total worked forests area in Andaman, is 1,00,000 ha. approx.
excluding Little Andaman

1,25,000 ha of plantations of hardwoods

SILVICULTURE BASED WORKING PLANS PREPARED FOR TIMBER EXTRACTION

ANDAMAN & NICOBAR ISLANDS

Sound and exploitable trees standing in open/blank, should not be marked for felling.

All the trees within 10m and 20m on either side of seasonal and perennial water sources respectively shall be retained to conserve soil and water.

No marking of trees should be carried out on hills/steep slopes > 45º gradient and slide prone hills areas shall be totally protected.

No trees to be felled within 50 m of another tree of exploitable girth.

Plantation WC – Special objectives of management

- Restoring the tropical rain forests and its rich biodiversity in consistence with the National Forest Policy.

- To phase out monoculture plantation and bring back the area closer to natural eco-profile through silvicultural intervention on attaining the age of maturity.

- To meet the requirement of NTFP and small timber to local inhabitant in consistent with biodiversity conservation

Plantation WC – Special objectives of management

- By selective removal of trees and raising artificial plantation of indigenous species without any deterioration in the site quality.
- By adopting shelter wood approach to convert the plantations of monoculture species gradually in to close to its natural profile

Phasing out exotics as per the ruling of Hon'ble Supreme Court.

- The removal of teak over wood will not be done unless and until the replacement species have established. The survival of 60% all over of the planted species with height growth of 3 mtrs atleast will be stage at which removal of teak over wood will be contemplated.
- Utmost care will be taken to see that teak over wood removal does not damage the replacement plantings.

Rules for marking

All the dead, dying, diseased, broken, top broken and suppressed trees should be marked for felling

In addition, trees which falls within the ambit of silvicultural thinning shall also be marked for felling without executing heavy opening.

Yield from such areas will be incidental to the silvicultural operation.

Choice of Silvicultural System

SUITABILITY OF SYSTEM TO THE SPS. - IMP FACTORS :

1. LIGHT REQUIREMENT, SEEDING, REGENERATION.

A. LIGHT DEMANDER - CLEAR FELLING : SHADE BEARERS – SELECTION METHOD : COPPICERS – COPPICE SYSTEMS

B. NATURAL REGENERATION (SEED/SEEDLING COPPICE) PROFUSE – CLEAR FELLING WITH NATURAL REGENERATION. IF NATURAL REG. DIFFICULT, ARTIFICIAL REGENERATION (IF NOT AN ISSUE)

C. NATURAL REGENERATION IN SHORT PERIOD – SHELTERWOOD SYSTEM, CONCENTRATED REGENERATION

D. DIFFICULT NATURAL/ARTIFICIAL REGENERATION – SELECTION/INDIAN IRREGULAR SHELTERWOOD

Choice of Silvicultural System

2) GEOLOGY

- CATCHMENT AREAS, SLOPES, PRONE TO EROSION – SELECTION/INDIAN IRREGULAR SHELTERWOOD AND NOT CLEAR/UNIFORM FELLING

3) RESISTANCE TO EXTERNAL FACTORS

- STORM, FROST, INSECTS/PESTS - SHELTERWOOD SYSTEM, INDIAN IRREGULAR SHELTERWOOD, SELECTION. IF PRONE TO WEEDS, SELECTION INSTEAD OF SHELTERWOOD

Choice of Silvicultural System

4)MANAGEMENT OBJECTIVE

- **POLES, SMALL WOOD – COPPICE; LARGE TIMBER- HIGH FOREST**

5) ECONOMIC CONSIDERATIONS

- **COST ADVANTAGE – CONC. REGENERATION;**
- **OPERATIONAL COST- SELECTION,**
- **EARLY RETURNS – COPPICE, CLEAR FELLING - SHORT ROTATION WITH ARTIFICIAL REGENERATION**
- **HIGH FOREST SYSTEMS – EARLY RETURNS IN TWO STOREY FORESTS, RETURNS DUE TO THINNING IN EVEN AGED SYSTEMS**

Choice of Silvicultural System

6) TRANSPORTATION COST

- INACCESSIBLE – SELECTION, HIGH COST TO TRANSPORT SMALL WOOD

7) AVAILABILITY OF LABOUR

- MORE LABOUR – CLEAR FELLING SYSTEMS;
- SKILLED LABOUR – SELECTION SYSTEM (MARKING, FELLING WITHOUT DAMAGE); MIXED FORESTS WITH SHELTERWOOD SYSTEM

Choice of Silvicultural System

8) RIGHTS OF PEOPLE :

- Small timber to people –coppice, Grazing rights – cannot be closed for long, only short rotation.

9) AESTHETICS

- Selection system – more aesthetic

Choice of Silvicultural Systems

– SUSTAINABILITY !

THE PARADIGM SHIFT…

- ✔ PRODUCTION TO CONSERVATION
- ✔ MULTIPLE USE TO MULTIPLE VALUES
- ✔ SUSTAINED YIELD TO SUSTAINABILITY
- ✔ SPECIES TO ECOSYSTEM
- ✔ FOREST STAND TO LANDSCAPE APPROACH
- ✔ PARTICIPATORY APPROACH

National Working Plan Code 2014

- **More people centric and oriented to provide the goods and services from forests on sustained basis, with an emphasis on ecological services and harvest of usufructs as well.**

- ENVIRONMENTAL STABILITY,
- BIODIVERSITY MONITORING & MANAGEMENT,
- RESTORATION OF DISTURBED AREAS,
- PROTECTIVE FUNCTIONS OF THE FOREST RESOURCES, AND
- OTHER SOCIO-ECONOMIC BENEFITS BASED ON NON-TIMBER FOREST PRODUCTS (NTFPS).

National Working Plan Code 2014

- BIODIVERSITY CONSERVATION & DEVELOPMENT
- WATER RESOURCES MANAGEMENT
- SOIL & WATER CONSERVATION
- FORESTS & CLIMATE CHANGE

SILVICULTURE – *NEW TRENDS*

TRADITIONAL SILVICULTURE AIMED AT REDUCING THE COMPLEXITY OF FORESTS IN ORDER TO OBTAIN MAXIMUM TIMBER YIELD.

HOMOGENEOUS FORESTS PRODUCED BY TRADITIONAL SILVICULTURAL PRACTICES CAN NO LONGER SATISFY SOCIETY'S NEEDS FOR MULTIPLE ECOSYSTEM SERVICES

SILVICULTURE – *NEW TRENDS*

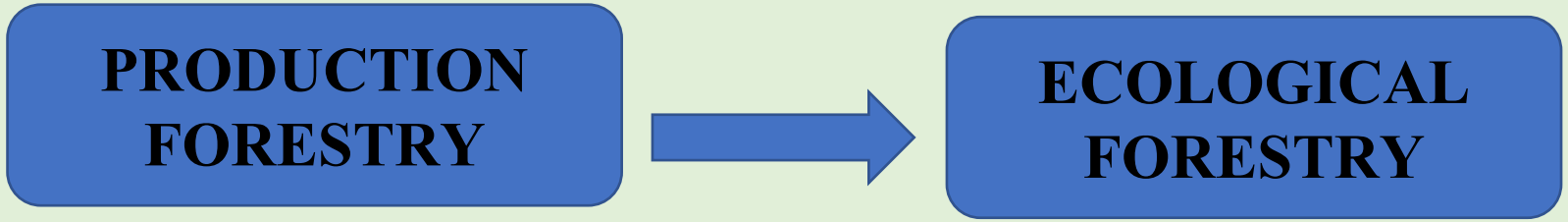
RECENT DEVELOPMENTS IN SILVICULTURE HAVE CHANGED ITS FOCUS AND PRINCIPLES

MAINTAINING AND IMPROVING THE COMPLEXITY OF STRUCTURE AND THE DIVERSITY OF FUNCTIONS OF FORESTS ARE THE NEW NORMS

SUSTAINABLE FOREST MANAGEMENT

- EARLIER, FOCUSED ON PRODUCTION OF **SUSTAINED YIELD** FROM FORESTS.
- ECOSYSTEM MANAGEMENT OF FORESTS IS ***MORE HOLISTIC*** IN ITS APPLICATION AND CONSIDERS ENVIRONMENTAL SERVICES TOO.
- ORIGINAL INTENT TO INTEGRATE ECOLOGICAL, SOCIAL, AND ECONOMIC VALUES NOT EFFECTIVELY DONE.

- FORESTRY THAT FOCUSES ON ……
  - RESTORING,
  - REHABILITATING AND
  - MAINTAINING THE ECOLOGICAL INTEGRITY OF FOREST ECOSYSTEMS

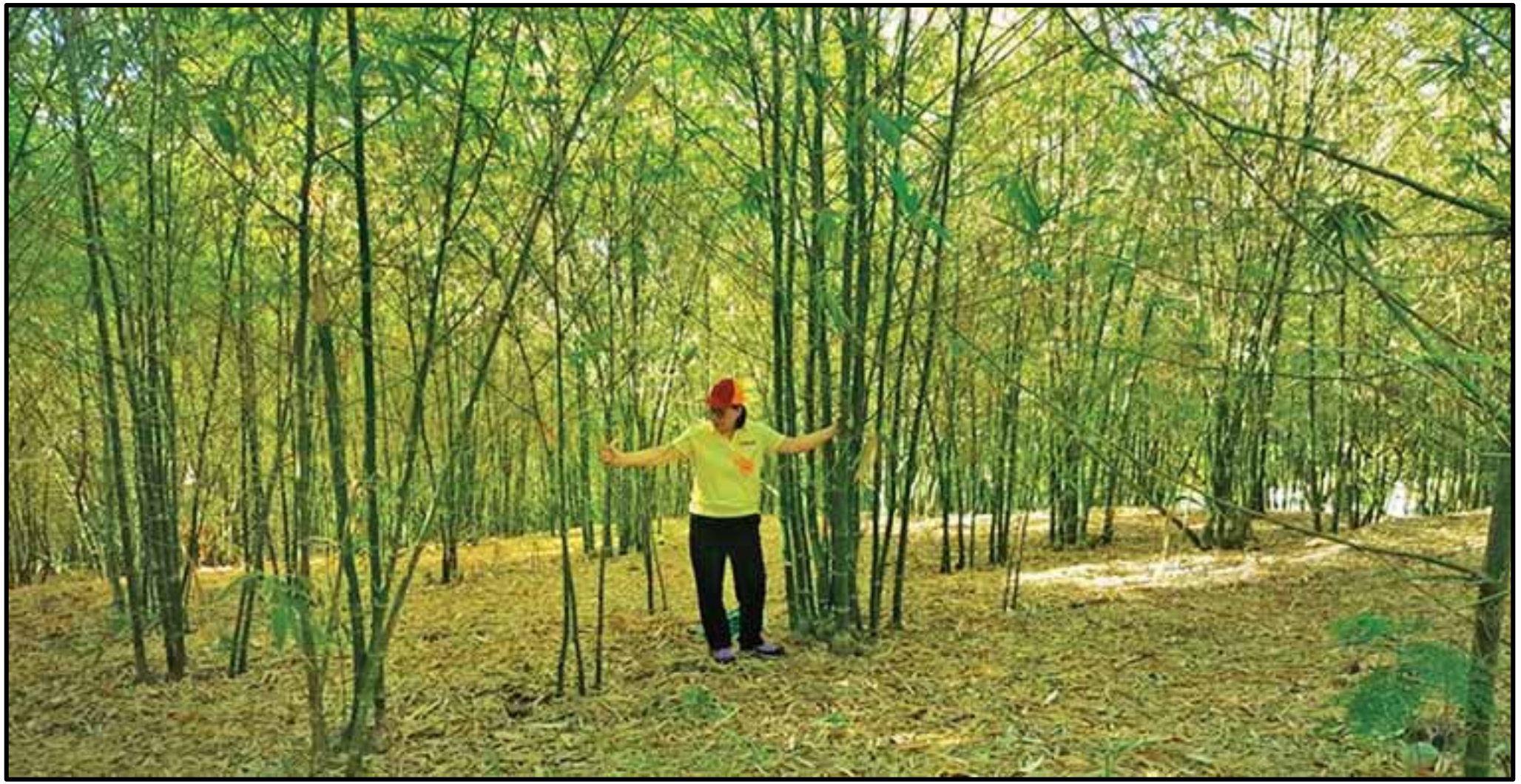


Silvicultural Systems

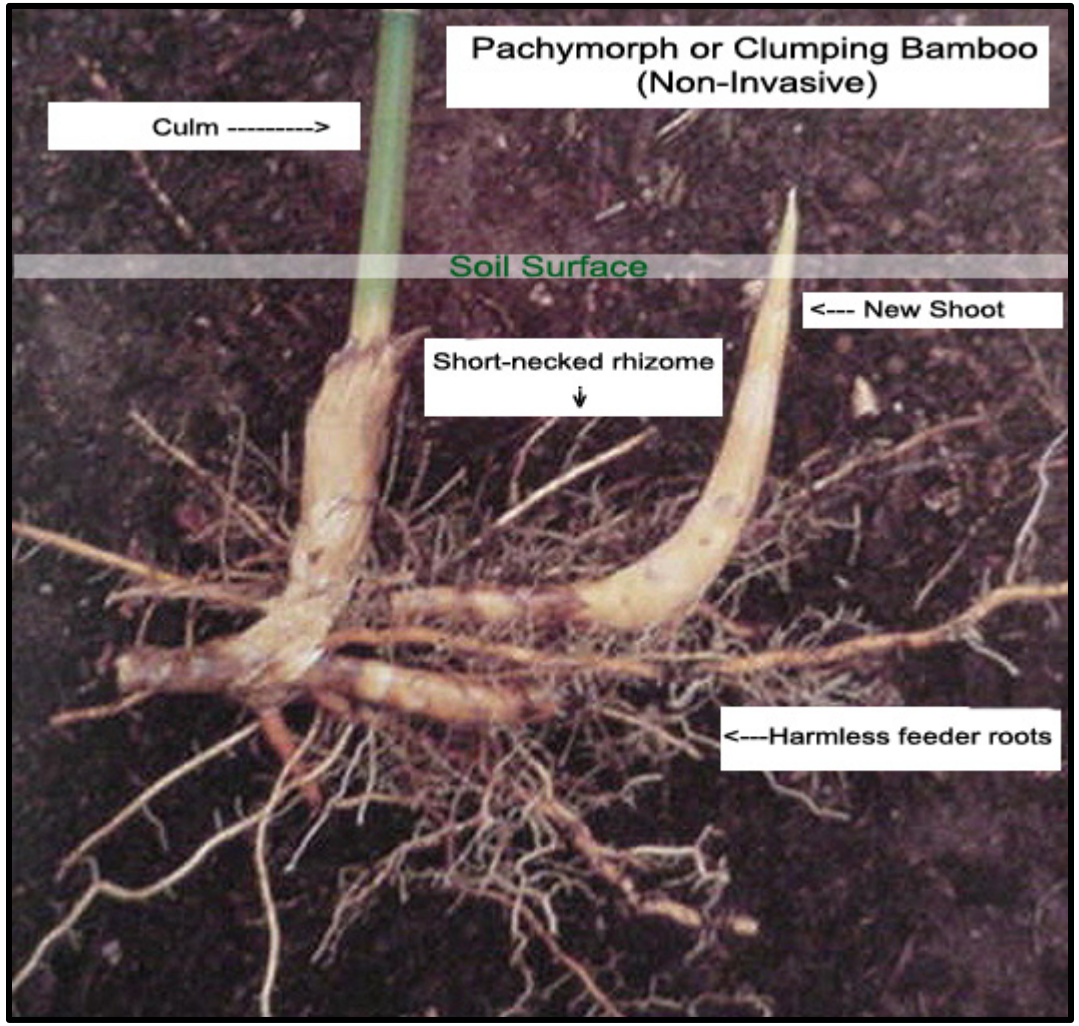
" In the wake of increasing population and more intensive utilization of land for agriculture and other purposes, no Government is likely to allow its forest department to grow forests which do not confer even a fraction of the direct benefits they are capable of under intensive management merely because there is possibility of the soil productivity going down."

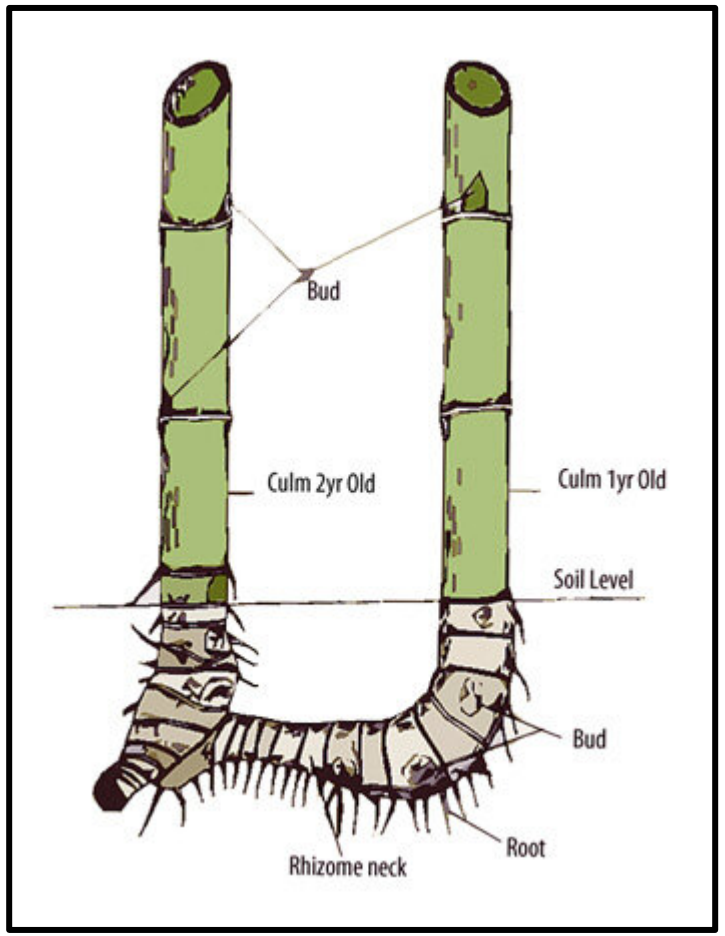
Employment potential, requirements of population and industries

Management of Bamboos



Management of Bamboos





Management of Bamboos

Bamboo Management

propagation

- Rhizome from base grows downwards for small distance, curves up to produce small culm.
- New culms on the periphery every year as rhizome usually develops centre outwards
- In some sps, like *Dendrocalamus strictus*, rhizome sections short-culms close to clump(esp. in poor soils)
- If outer rhizome damaged, new culms within existing one

Bamboo Management

propagation

- Flowering varies with sps., Sporadically one/few in a clump or few clumps in a locality every year.
- Sometimes all clumps of a sps in a locality flower simultaneously – gregarious flowering

Bamboo Management

propagation

Gregarious flowering Areas

- Cut only after seed is shed
- Area closed to grazing and fire protected
- Closure till young bamboos established

Bamboo Management

Culm Selection System

Felling Cycle – 3-4 years

Imp. Felling rules

- Restriction in cutting one/two year culms
- Retention of old bamboo to support immature ones (atleast 6)
- Digging of rhizomes prohibited

Bamboo Management

Culm Selection System

- Ht- 15 cm with atleast one node left
- Cutting with sharp instrument to avoid split
- If flowering, cut only when seed is shed
- Old culms if flowering expected in abt 5 years –spared
- If peripheral surface exposed, necessary treatment

Bamboo Management

Regeneration

- New clumps from rhizome naturally
- Seedlings after sporadic flowering (Natural regeneration)
- Blanks -planting

Bamboo Management

Culm Working

Bamboo Management

Bamboo forest types - MP

~~Type I – well stocked areas- worked as above~~

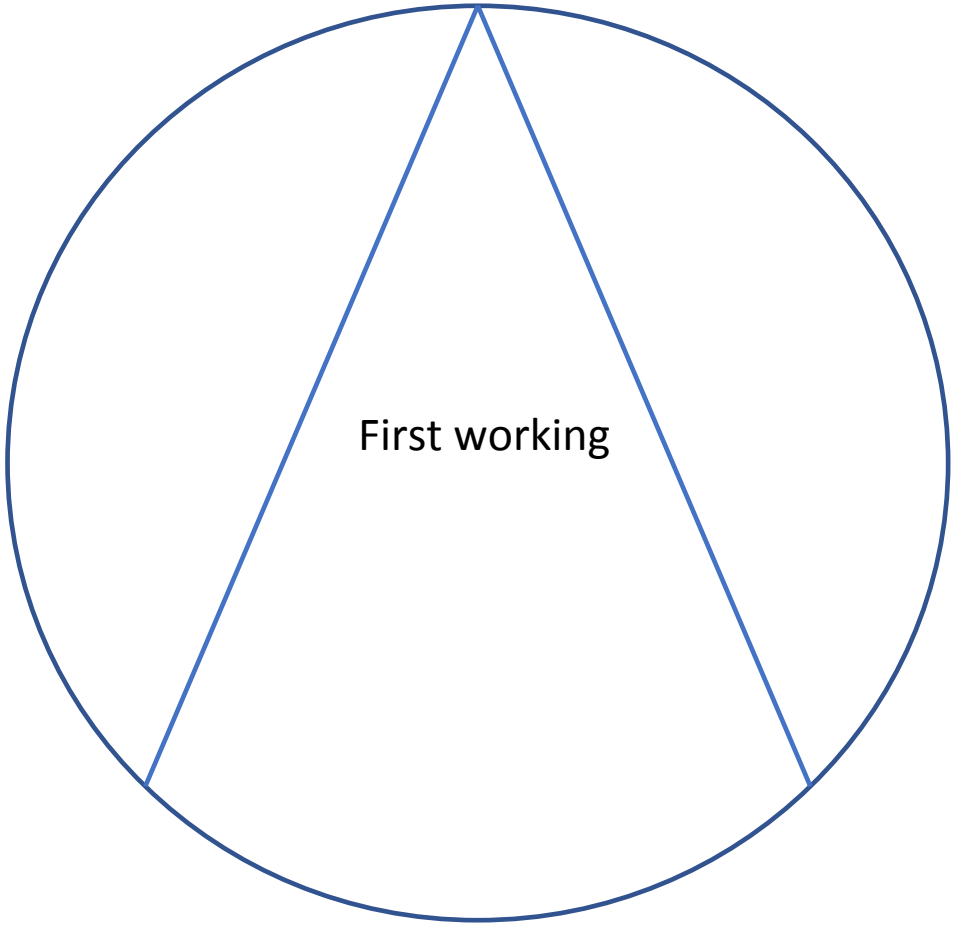
Type II – well stocked, but malformed (lopping/congestion), - no commercial fellings-only tending/pruning. Congested culms- not more than one third in one working – middle portion cut first

Type III - Sparse stocking – augumented by raising plantation

Bamboo Management

Bamboo forest types - MP

Type II –one third in one working – middle portion cut first



National Forest Policy – 1894

Classification of Forests

1. Essential on climatic or physical grounds
2. Supply of valuable timbers for commercial purposes
3. Minor Forests
4. Pasture lands

- No attempts to classify in one or other category as intermediate categories / category etc.
- Consideration to local circumstances.

National Forest Policy -1952

Functional classification of forests (whether State/privately owned)

- Protected forests – climatic/physical considerations
- National forests – Needs of various sectors
- Village forests – grazing, firewood, small timber
- Tree lands – outside scope of ordinary forest management

Classification no bearing on Forest Act 1927 – Classification not mutually exclusive.

National Forest Policy- 1984
OBJECTIVES

ENVIRONMENT STABILITY

RESTORING ECOLOGICAL BALANCE

PRESERVING REMAINING NATURAL FORESTS

CHECKING SOIL EROSION, DESERT EXPANSION

MEETING REQUIREMENT OF LOCALS – fuel wood, fodder, MFP

National Forest Policy- 1984
OBJECTIVES

NEEDS OF **WILDLIFE CONSERVATION**

INCREASING PRODUCTIVITY OF FORESTS

ENCOURAGE EFFICIENT UTILISATION OF FOREST PRODUCE &

MAXIMISE SUBSTITUTION OF WOOD

National Forest Policy- 1984

Management of State Forests

NO CLEAR FELLING OF STOCKED NATURAL FORESTS

PRODUCTION FORESTRY PROGRAMS AIM –

Increase in forest cover

Narrow gap between demand & supply of fuelwood

NO EXOTICS TO BE INTRODUCED, without trials

National Forest Policy- 1984
Forest Based Industries

NATURAL FORESTS WILL NOT BE MADE AVAILABLE

TO INDUSTRIES FOR RAISING PLANTATION